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NORTH AMERICAN AIR DEFENSE COMMAND

WIR

WEEKLY INTELLIGENCE REVIEW (U)

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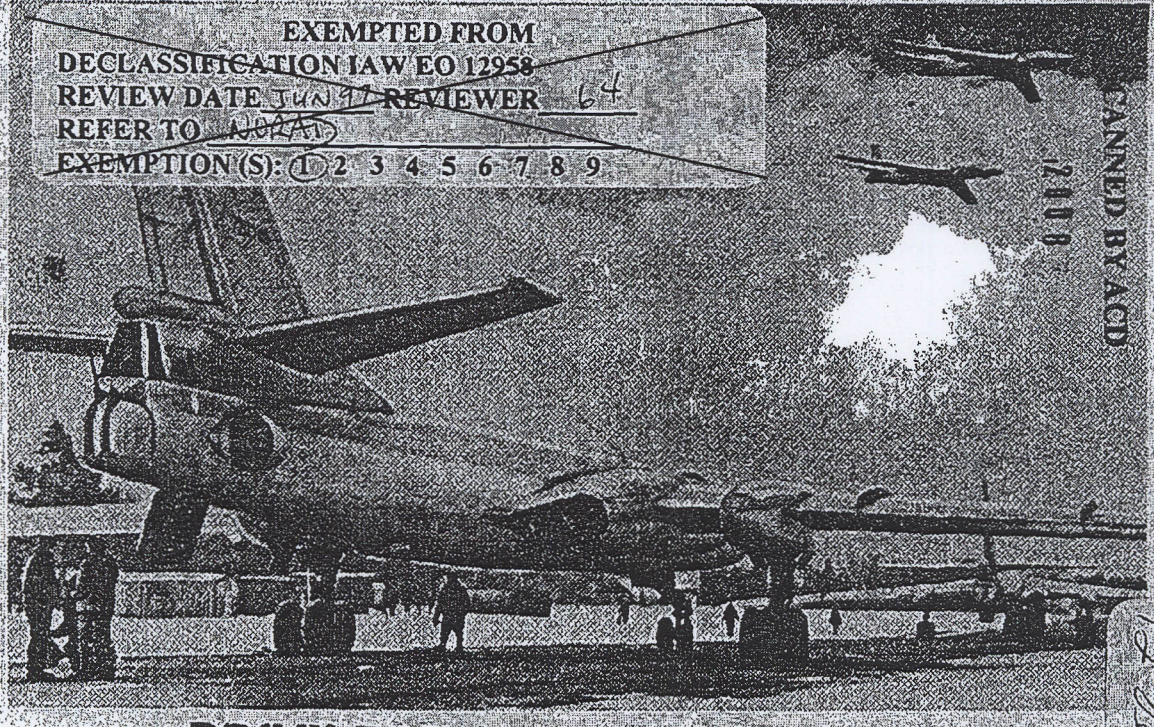

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12 Feb 1965

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NORAD Weekly Intelligence Review

Issue No. 7/65, 12 February 1965

The WIR in Brief

COVER: Soviet BADGER jet medium bombers (from Red Star) (OFFICIAL USE ONLY)

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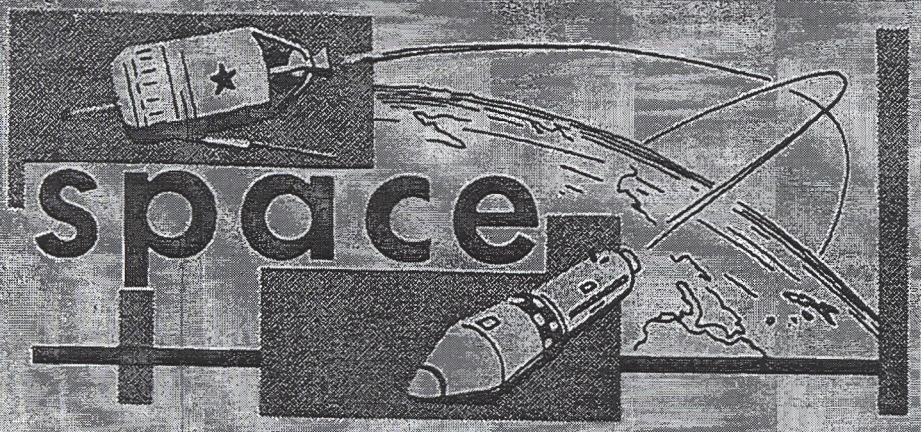

significant intelligence on space developments and trends

Soviets Far Behind in Radiation-Belt Research

A condensation and adaptation of a CIA study.

US space scientists were deeply chagrined on 15 May 1958 when the Soviets orbited Sputnik 3, a 1.5-ton satellite heavily instrumented to collect a wide variety of data on near-Earth space. The US space program at that time was noted chiefly for high failure rates and low payload weights. The 3 small US satellites launched prior to 15 May 1958 had a combined weight of only 65 pounds. The Soviets were obviously so far ahead in payload capabilities that the US seemed doomed to lag behind the USSR in space research for a long time.

A 1964 survey indicates, on the contrary, that the US already is far ahead of the Soviets in perhaps the most complex area of space research -- study of the Earth's radiation belts -- despite the fact that the Soviets still lead in operational payload-weight capabilities. In fact it now appears that, unless their program is given more impetus and support, the Soviets will not catch up with the US in radiation-belt research for several years to come.

The belts, named after their discoverer, Van Allen, are being studied in the US more closely than any other area of the space sciences because of:

- Their complexity.
- The hazards which they pose to many space projects, such as manned flight.
- Their apparent relationship to geophysical phenomena in general: they respond to the same forces that cause the aurora, ionospheric disturbances, and magnetic storms.

Also, these studies took on new importance when it was learned that nuclear explosions in space or high in the atmosphere could create artificial

belts of electrons more deadly than the natural belts -- and at lower altitudes, where early manned flights were to take place.

Data Collection. Soviet collection of data on radiation belts is inferior in both quantity and quality to that of the US. Too few Soviet space vehicles have been committed to the program, instrumentation too often has failed or been unstable, and, at least prior to the launch of the Electron probes in 1964, orbital parameters were not varied enough to give the Soviets a good picture of the extent and nature of the belts.

Soviet satellites carrying radiation-belt instrumentation had, by the end of 1961, operated (collected and transmitted data) in the belts for only 41 days, in contrast with the US's 1100 days. The Soviets, by the end of 1962, had collected no more data than the US had by about mid-1960. (For a graphic comparison, see chart on page 33.)

As of the end of 1963, less than one percent of Soviet radiation-belt data had been collected at distances of greater than 1500 kilometers (800 n.m.) from the Earth. With the launch of their Electron probes in 1964, they have made some progress in correcting this deficiency. (Although all 4 of these vehicles are still in orbit, only one is now transmitting.)

Ironically, it was a deficiency in Soviet satellite instrumentation that allowed the US's 31-pound Explorer, rather than the Soviets' 1100-pound Sputnik 2, to discover the radiation belts.

Data Handling. A special feature of radiation-belt research is the large volume of data that must be collected, transmitted from space, received on the ground, and organized into logical and useful form. Ideally, every data point produced by satellite instrumentation should be labeled with the time of collection, the location of the satellite in a convenient coordinate system, and the orientation of the instrument involved. But Soviet radiation-belt workers do not appear to have at their disposal the required hardware and techniques.

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The Soviets are also well behind the US in the use of suitable coordinate systems for mapping their data. They have had difficulty in using the US's B-L system but will not be able to exploit US-published material until they develop proficiency in its use.

Up-to-date radiation-belt research is virtually impossible without ready access to large, high-speed digital computers, especially those with high-speed inputs and outputs. These machines are in short supply in the USSR and it appears that, in gaining access to them, radiation-belt research plays third fiddle to military and economic research. It is no wonder, then, that Soviet papers presenting qualitative results of radiation-belt research have never reflected the use of large quantities of data.

Soviet-Published Studies. The Soviets to date have contributed very little to the existing fund of man's knowledge about the composition and structure of the Earth's natural radiation belts. What they have published has, for the most part, been copied from US work, lacking in significance, or simply in error. Similarly, they have not been impressive in their contributions about the dynamics of the belts -- the sources of trapped particles, the forces that accelerate and decelerate them, and the means or causes of their disappearance from the belts. These shortcomings follow, to a large extent, from Soviet deficiencies in data collection and data handling.

Investigation of Artificial Belts. The Soviets in late 1962 tried to study the formation of artificial radiation belts during a series of high-altitude nuclear tests, using Cosmos 11 as an instrument carrier. Such a study is important because:

- An artificial belt can make manned orbital flight temporarily impossible, as, indeed, one did in the past.
- Observations made during the formation of an artificial belt could contribute to an understanding of the dynamics of the natural belts.

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A repetition of this experiment presently is prohibited by the ban on nuclear testing in the atmosphere, which the Soviets have signed.

Support of Manned Space Flight. The brightest spot in Soviet near-Earth radiation research is that accomplished in support of manned flight. The Soviets' method has been strictly pragmatic: they made direct measurements of the radiation which their cosmonauts could expect to encounter, placing suitable instruments inside satellites similar to those which would carry the cosmonauts and injecting these precursor satellites into appropriate orbits. The Soviets were forced into the use of this direct, simple, but effective method, because they knew they could not predict the amount of radiation which would be encountered or the protection which vehicle shielding would afford.

Review and Preview. The Soviets, as of a year ago, were about 2.5 years behind the US in radiation-belt research and it is not believed that they will be able to close the gap for some time to come. Their program suffers from an inadequacy in numbers of satellites committed to the program, a lack of orbital diversity, shortcomings in instrumentation and telemetry, and a shortage in the USSR of large digital computers with high-speed inputs and outputs. These deficiencies follow from the low priority awarded the space sciences in the USSR.

Prospects for improvement are dim. For example, one of the Soviet groups now involved may drop out of the program when its needs are satisfied; also, the Soviets do not seem to be training any input of bright, young scientists for the space sciences.

Conditions could change if radiation-belt research is given higher priority, but the Soviets would still have a great deal to learn before they could achieve even the present level of US competence. For example, it could take them several years to develop the means for automating completely the flow of data from satellite instrumentation to computer.

Access to the US open literature on radiation-belt research will not be of much help in closing the gap. The lag between US data collection and publication of results may be 6 to 36 months, or even longer. Also, there is a large body of important material -- raw data, techniques of investigation, preliminary results, and informal criticism and discussions -- which has not been and may never be published.

(CIA)

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Recovery Landing System of Voskhod Might Be Used for Escape During Launch Emergencies

The 3-man Voskhod capsule, unlike the six 1-man Vostoks which preceded it into space, had no ejection seats, according to the Soviets. All the Vostok passengers, except for Gagarin, ejected during the recovery phase of their flights and then landed with their personal parachutes. The seat was also designed to allow for escape in case of an emergency on the pad or during an early portion of the boost phase of propulsion.

The lack of an ejection seat on the Voskhod might seem to indicate that this vehicle had no provision for emergency escape during a launch emergency. Analysis now suggests that the entire capsule may have been intended to serve as an emergency escape vehicle. In such an emergency, the new retrorocket, which ordinarily would be used, after re-entry, to soft-land the parachuting Voskhod, would eject the entire capsule from the carrier rocket; the parachute would then deploy and lower the capsule to the ground at a rate of descent of about 22 feet per second. This is even slower than the 33 feet-per-second impact which Gagarin experienced in Vostok 1.

The retrorocket may even have had a third possible function -- that of backup for the braking rocket used to de-orbit the vehicle.
(FTD)
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Unused Voskhod Weight Could Be Exploited in Longer Manned Flight or in Maneuvering

The Soviets have announced that the 3-man Voskhod which they launched on 12 October 1964 weighed 11,730 pounds (p. 8, WIR 5/65). This is 270 pounds lighter than the 12,000-pound estimated lower limit. More particularly, it is 2,000-3,000 pounds lighter than the payload which the propulsion system evidently used in the Voskhod operation is believed capable of injecting into low orbit. This 1-1.5-ton reserve payload potential might be exploited in the future for either or both of the following purposes:

- Increased life-support equipment or supplies for prolonged manned flights.
- An added propulsion system for executing limited orbital maneuvers or rendezvous and docking. In connection with the latter, it may be pertinent that the Soviets have said that the Voskhod's TV system could be used by the crew to look back and see beyond the instrumentation section and retrorocket installations -- a capability which would be most valuable for performing rendezvous or monitoring hookup with another orbiting vehicle.

(DIA; NORAD)
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Probable Zond 2 Signals Received Again; Moscow Still Mum on Probe's Progress

A European sensor reports receiving signals which may have been transmitted by Zond 2, probable Mars probe launched by the Soviets on 30 November 1964. The signals were received during the period 2223-2226Z, 3 February 1965, [redacted] Zond 2's transmitting frequency.

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The Soviet vehicle, according to an analysis of 2 photographic observations of the probe made by Mt. Palomar, California, in early December, is headed in the general direction of Mars. However, the Soviets apparently should have made a course correction sometime in December if they intended that the vehicle approach Mars close enough (within about 50,000 miles) to make useful observations of the planet. They have not yet reported making any such correction, although they claimed in the past to have made mid-course guidance corrections for Mars 1 and Zond 1, two previous Soviet interplanetary probes.

Moscow has been mysteriously silent about Zond 2. They have not, as of this writing (10 February), reported any communications with this probe since 20 December 1964, when TASS said that 12 communications sessions had been held with the probe during the period 8-18 December. A long silence usually means that the Soviets have lost contact, but this may not be the case with Zond 2, which apparently is still transmitting. An attempted course correction may have failed, in which case the probe would have to be written off as a failure, even if it is still transmitting. Silence is the nearest that the Soviets ever come to an admission of failure. It is still too early, however, to draw any firm conclusions.

(European sensor; Mt. Palomar; NORAD)

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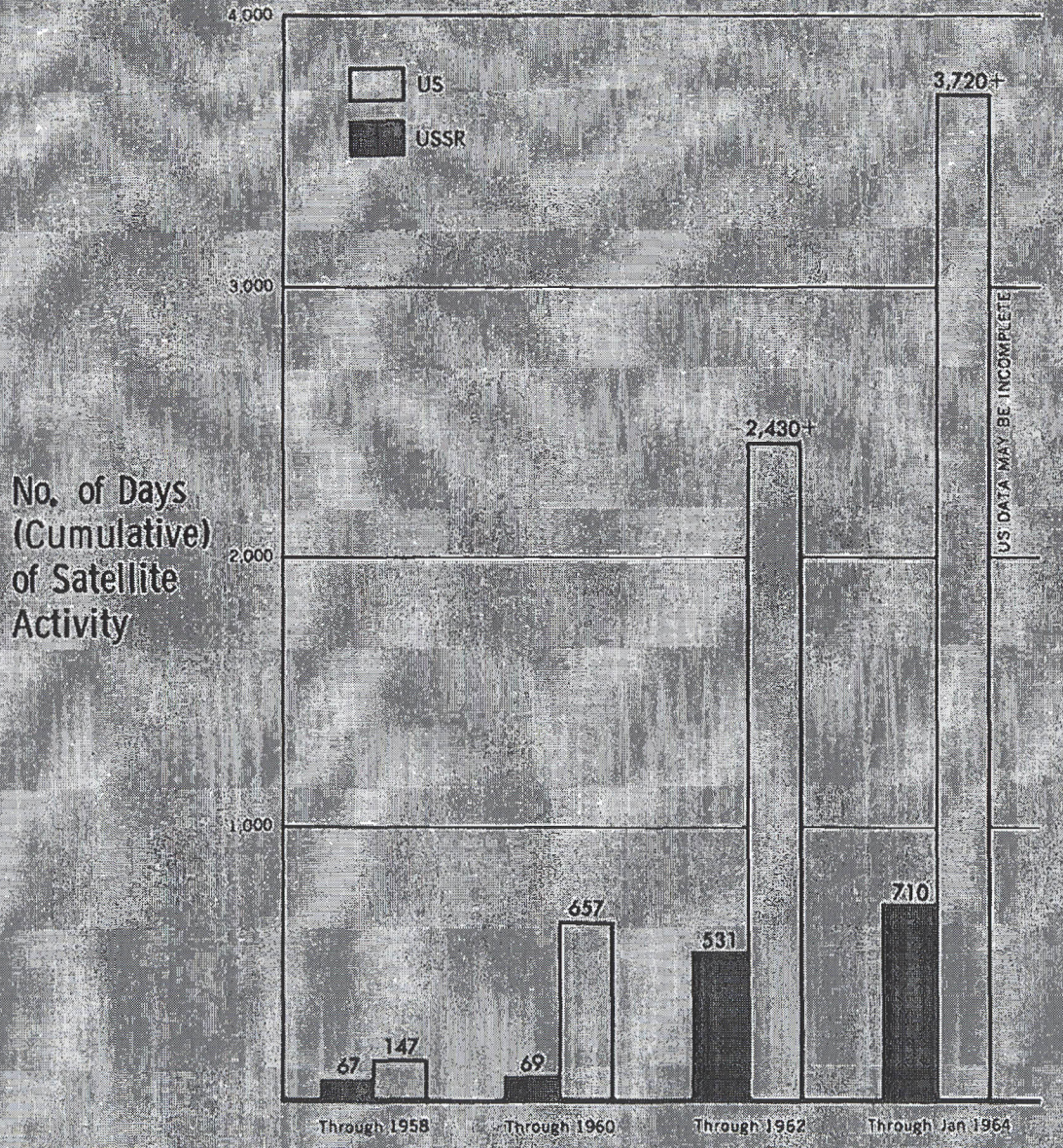
Exploration of the Earth's Radiation Belts by Satellites: A Comparison of Soviet and US Activity



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